REMARKS

The present application was filed on April 19, 2001 with claims 1 through 60. Claims 1 through 60 are presently pending in the above-identified patent application. Claims 46, 55, and 60 are proposed to be amended herein.

5   In the Office Action, the Examiner questioned why an information disclosure statement was not filed for the documents cited in the specification. The Examiner objected to the specification and FIG. 8 due to indicated informalities. The Examiner rejected claims 24, 52, and 57 under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter

10   which applicant regards as the invention. The Examiner rejected claims 1-50 under 35 U.S.C. §101 because the claimed invention is not supported by an asserted or well established utility and is not tangible, and rejected claims 1-50 under 35 U.S.C. §101 because they appear to be reciting a mathematical algorithm, therefore not producing a concrete, useful, and tangible result. The Examiner also rejected claims 1, 15-19, 21, 23,

15   24, 29, 35-37, 39, 52, 54, 56, 57, and 59 under 35 U.S.C. §102(b) as being anticipated by Bahl et al. (United States Patent Number 4,817,156; hereinafter, Bahl '156), rejected claims 46-50, 55, and 60 under 35 U.S.C. §102(b) as being anticipated by Gravier et al. (Gravier et al., Directory Name Retrieval Using HMM Modeling and Robust Lexical Access," Automatic Speech Recognition and Understanding, 1997, Proceedings, 1997

20   IEEE Workshop on, 14-17 December 1997, Pages 558-565), rejected claims 2-14 under 35 U.S.C. §103(a) as being unpatentable over Bahl '156, and further in view of Stolcke (Stolcke, Andreas, "An Efficient Probablistic Context-free Parsing Algorithm that Computes Prefix Probabilities," Computational Lingustics, Volume 21, Issue 2, June 1995, pages 165-201), rejected claims 20 and 38 under 35 U.S.C. §103(a) as being

25   unpatentable over Bahl '156, and further in view of Bahl et al. (Bahl et al., "Constructing Groups of Acoustically Confusable Words," Acoustics, Speech, and Signal Processing, 1990, ICASSP-90, 1990, International Conference on, 3-6 April 1990, pages 85-88 Vol. 1), rejected claims 22, 25, 53, and 58 under 35 U.S.C. §103(a) as being unpatentable over Bahl '156, and further in view of Jelinek (Jelinek, F., "Self-organized Language

30   Modeling for Speech Recognition," Readings in Speech Recognition, page 474, 1990), rejected claim 40 under 35 U.S.C. §103(a) as being unpatentable over Bahl '156, in view

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of Stolcke, and further in view of Official Notice, and rejected claims 41-45 under 35 U.S.C. §103(a) as being unpatentable over Bahl '156, and further in view of Gravier et al.

Information Disclosure Statement

The Examiner questioned why an information disclosure statement was

5   not filed for the documents cited in the specification.

The documents cited in the specification were not included in the information disclosure statement since they were included solely as background material and are not pertinent to the patentability of the present invention. If the Examiner would like a copy of any such reference, the Examiner is invited to contact the undersigned

10   attorney.

Formal Objections

The specification and FIG. 8 were objected to due to indicated informalities. The specification and FIG. 8 have been amended to correct the typographical errors cited by the Examiner. Applicants respectfully request that the

15   objections to the specification and FIG. 8 be withdrawn.

Section 112 Rejections

Claims 24, 52, and 57 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, the Examiner

20   asserts that the limitation "determining a metric" is unclear as to what the metric refers.

The Examiner has identified two metrics that can be determined by using the acoustic confusabilities required by the second limitation of claims 24, 52, and 57, as defined in the present disclosure. In light of the present disclosure, a person of ordinary skill in the art would recognize the metrics that can be determined by using the acoustic

25   confusabilities.

Section 101 Rejections

Claims 1-50 were rejected under 35 U.S.C. §101 because the claimed invention is not supported by an asserted or well established utility and is not tangible, and rejected claims 1-50 under 35 U.S.C. §101 because they appear to be reciting a

30   mathematical algorithm, therefore not producing a concrete, useful, and tangible result.

The Invention Accomplishes a Practical Application

The cited claims are directed to methods for the computation of the numerical quantities called acoustic confusability, acoustic perplexity, and synthetic word error rate, used in the creation and operation of speech recognition systems, and are directed to the technological arts. Applicants also note that the Supreme Court has stated that the "[t]ransformation and reduction of an article 'to a different state or thing' is the clue to patentability of a process claim." *Gottshalk v. Benson*, 409 U.S. 63, 70, 175 U.S.P.Q. (BNA) 676 (1972). In other words, claims that require some kind of transformation of subject matter, which has been held to <u>include intangible</u> subject matter, such as <u>data</u> or signals, that are representative of or constitute physical activity or objects have been held to comply with Section 101. *See, for example, In re Warmerdam*, 31 U.S.P.Q.2d (BNA) 1754, 1759 n.5 (Fed. Cir. 1994) or *In re Schrader*, 22 F.3d 290, 295, 30 U.S.P.Q.2d (BNA) 1455, 1459 n.12 (Fed. Cir. 1994).

The cited claims require the computation of the numerical quantities called acoustic confusability, acoustic perplexity, and synthetic word error rate, used in the creation and operation of speech recognition systems. These transformations to compute numerical quantities in this manner are useful, concrete, and tangible results. See, e.g., USPTO Examination Guidelines for Computer-Related Inventions," (hereinafter, "Guidelines") § II. A.

Statutory Process Claims

The Guidelines establish that "[t]o be statutory, a claimed computer-related process must **either**: (A) result in a physical transformation outside the computer for which a practical application in the technological arts is either disclosed in the specification or would have been known to a skilled artisan (discussed in i) below), or (B) be limited to a practical application within the technological arts (discussed in ii) below). Guidelines, § IV(2)(b). The Examiner has considered only the second portion of this test.

The claimed process clearly results in a physical transformation outside of a computer for which a practical application in the technological arts is either disclosed in the specification or would have been apparent to a person of ordinary skill in the art. Again, the cited claims require the computation of the numerical quantities called acoustic confusability, acoustic perplexity, and synthetic word error rate, used in the creation and operation of speech recognition systems.

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Thus, Applicants submit that each of the claims 1-50 are in full compliance with 35 U.S.C. §101, and accordingly, respectfully requests that the rejection under 35 U.S.C. §101 be withdrawn.

Independent Claims 1, 15, 24, 51, 52, 56 and 57

Independent claims 1, 15, 24, (51), 52, 56, and 57 were rejected under 35 U.S.C. §102(b) as being anticipated by Bahl '156. Regarding claims 1 and 51, the Examiner asserts that Bahl teaches creating an evaluation model from at least one evaluation phone (col. 12, lines 36-41); creating a synthesizer model from at least one synthesizer phone (col. 12, lines 46-51); and determining a matrix from the evaluation and synthesizer models (FIG. 13 and description).

Applicants note that the present invention defines synthesizing a sample to mean *using the HMM to generate a sample of speech*. Bahl, on the other hand, teaches to *collect samples of speech* and does *not* disclose or suggest *"synthetic likelihood"* or *"synthesizing."* In addition, in the present invention, the *confusability metric* can be computed entirely *without explicitly generating samples of speech from the HMM*, and thus takes into account an infinite amount of speech samples without explicitly generating and enumerating the samples. Independent claims 1, 51, and 56 require creating a *synthesizer model* from at least one synthesizer phone; and determining a matrix from the evaluation and synthesizer models. Independent claim 15 requires creating a *synthesizer model* from a plurality of synthesizer phones, each of the phones corresponding to a second word; creating a product machine from the evaluation model and synthesizer model, the product machine comprising a plurality of transitions and a plurality of states; determining a matrix from the product machine; and determining acoustic confusability of the first word and the second word by using the matrix. Independent claims 24, 52, and 57 require determining acoustic confusability for each of a plurality of word pairs; and determining a metric by using the acoustic confusabilities.

Thus, Bahl '156 does not disclose or suggest creating a synthesizer model from at least one synthesizer phone; and determining a matrix from the evaluation and synthesizer models, as required by independent claims 1, 51, and 56, does not disclose or suggest creating a synthesizer model from a plurality of synthesizer phones, each of the phones corresponding to a second word; creating a product machine from the evaluation

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model and synthesizer model, the product machine comprising a plurality of transitions and a plurality of states; determining a matrix from the product machine; and determining acoustic confusability of the first word and the second word by using the matrix, as required by independent claim 15, and does not disclose or suggest determining acoustic

5 confusability for each of a plurality of word pairs; and determining a metric by using the acoustic confusabilities, as required by independent claims 24, 52, and 57.

Independent Claims 46, 55 and 60

Independent claims 46, 55, and 60 under 35 U.S.C. §102(b) as being anticipated by Gravier et al. Regarding claims 46, 55, and 60, the Examiner asserts that

10 Gravier teaches determining an edit distance between each word of the word pair; and determining acoustic confusability from the edit distance (page 563, paragraph 2, sentence 2; abstract, sentence 4).

Applicants note that the present invention uses the acoustic model to *induce distances*. Independent claims 46, 55, and 60 have been amended to require

15 determining an edit distance between each word pair and an associated alignment; *assigning acoustic distances to each aligned phoneme pair*; and *determining an acoustic confusability by summing said acoustic distances*. Support for this amendment can be found in Sections 3 and 9 of the present disclosure. Gravier does *not* disclose or suggest assigning acoustic distances to each aligned phoneme pair, and does not disclose or

20 suggest determining an acoustic confusability by summing said acoustic distances.

Thus, Gravier does not disclose or suggest assigning acoustic distances to each aligned phoneme pair, and does not disclose or suggest determining an acoustic confusability by summing said acoustic distances, as required by independent claims 46, 55, and 60, as amended.

25 ### Additional Cited References

Stolcke was also cited by the Examiner for its disclosure of a matrix R as a matrix of the sum of probabilities for changes of state between two state machines. Applicants note that Stolcke is directed to an extension of Earley's parser for stochastic context-free grammars that computes various quantities given a stochastic context-free

30 grammar and an input string (sse, abstract). Stolcke, however, does not disclose or suggest synthesizing a sample as defined in the present invention, does not disclose or

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suggest that the confusability metric can be computed entirely without explicitly generating samples of speech from the HMM, and does not disclose or suggest assigning acoustic distances to each aligned phoneme pair; and determining an acoustic confusability by summing said acoustic distances.

5   Thus, Stolcke does not disclose or suggest creating a synthesizer model from at least one synthesizer phone; and determining a matrix from the evaluation and synthesizer models, as required by independent claims 1, 51, and 56, does not disclose or suggest creating a synthesizer model from a plurality of synthesizer phones, each of the phones corresponding to a second word; creating a product machine from the evaluation

10   model and synthesizer model, the product machine comprising a plurality of transitions and a plurality of states; determining a matrix from the product machine; and determining acoustic confusability of the first word and the second word by using the matrix, as required by independent claim 15, does not disclose or suggest determining acoustic confusability for each of a plurality of word pairs; and determining a metric by using the

15   acoustic confusabilities, as required by independent claims 24, 52, and 57, and does not disclose or suggest assigning acoustic distances to each aligned phoneme pair; and determining an acoustic confusability by summing said acoustic distances, as required by independent claims 46, 55, and 60, as amended.

          Bahl et al. (Bahl et al., "Constructing Groups of Acoustically Confusable

20   Words," Acoustics, Speech, and Signal Processing, 1990, ICASSP-90, 1990, International Conference on, 3-6 April 1990, pages 85-88 Vol. 1) was also cited by the Examiner for its disclosure of synthetic likelihoods compressed by ranking. Applicants note that Bahl is directed to methods for constructing groups of acoustically similar words in a large vocabulary speech recognition system (see, abstract). Bahl, however,

25   does not disclose or suggest synthesizing a sample as defined in the present invention, does not disclose or suggest that the confusability metric can be computed entirely without explicitly generating samples of speech from the HMM, and does not disclose or suggest assigning acoustic distances to each aligned phoneme pair; and determining an acoustic confusability by summing said acoustic distances.

30   Thus, Bahl et al. do not disclose or suggest creating a synthesizer model from at least one synthesizer phone; and determining a matrix from the evaluation and

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synthesizer models, as required by independent claims 1, 51, and 56, do not disclose or suggest creating a synthesizer model from a plurality of synthesizer phones, each of the phones corresponding to a second word; creating a product machine from the evaluation model and synthesizer model, the product machine comprising a plurality of transitions

5 and a plurality of states; determining a matrix from the product machine; and determining acoustic confusability of the first word and the second word by using the matrix, as required by independent claim 15, do not disclose or suggest determining acoustic confusability for each of a plurality of word pairs; and determining a metric by using the acoustic confusabilities, as required by independent claims 24, 52, and 57, and do not

10 disclose or suggest assigning acoustic distances to each aligned phoneme pair; and determining an acoustic confusability by summing said acoustic distances, as required by independent claims 46, 55, and 60, as amended.

Jelinek was also cited by the Examiner for its disclosure of determining acoustic perplexity by using the plurality of acoustic confusabilities. Applicants note that

15 Jelinek is directed to the problems of language modeling for speech recognition (see, introduction). Jelinek, however, does not disclose or suggest synthesizing a sample as defined in the present invention, does not disclose or suggest that the confusability metric can be computed entirely without explicitly generating samples of speech from the HMM, and does not disclose or suggest assigning acoustic distances to each aligned

20 phoneme pair; and determining an acoustic confusability by summing said acoustic distances.

Thus, Jelinek does not disclose or suggest creating a synthesizer model from at least one synthesizer phone; and determining a matrix from the evaluation and synthesizer models, as required by independent claims 1, 51, and 56, does not disclose or

25 suggest creating a synthesizer model from a plurality of synthesizer phones, each of the phones corresponding to a second word; creating a product machine from the evaluation model and synthesizer model, the product machine comprising a plurality of transitions and a plurality of states; determining a matrix from the product machine; and determining acoustic confusability of the first word and the second word by using the matrix, as

30 required by independent claim 15, does not disclose or suggest determining acoustic confusability for each of a plurality of word pairs; and determining a metric by using the

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acoustic confusabilities, as required by independent claims 24, 52, and 57, and does not disclose or suggest assigning acoustic distances to each aligned phoneme pair; and determining an acoustic confusability by summing said acoustic distances, as required by independent claims 46, 55, and 60, as amended.

5   <u>Dependent Claims 2-14, 16-23, 25-45, 47-50, 53, 54, 58 and 59</u>

Dependent claims 16-19, 21, 23, 29, 35-37, 39, 54, and 59 were rejected under 35 U.S.C. §102(b) as being anticipated by Bahl '156, claims 47-50 were rejected under 35 U.S.C. §102(b) as being anticipated by Gravier et al., claims 2-14 were rejected under 35 U.S.C. §103(a) as being unpatentable over Bahl '156, and further in view of

10 Stolcke, claims 20 and 38 were rejected under 35 U.S.C. §103(a) as being unpatentable over Bahl '156, and further in view of Bahl et al., claims 22, 25, 53, and 58 were rejected under 35 U.S.C. §103(a) as being unpatentable over Bahl '156, and further in view of Jelinek, claim 40 was rejected under 35 U.S.C. §103(a) as being unpatentable over Bahl '156, in view of Stolcke, and further in view of Official Notice, and claims 41-45 were

15 rejected under 35 U.S.C. §103(a) as being unpatentable over Bahl '156, and further in view of Gravier et al.

Claims 2-14, 16-23, 25-45, 47-50, 53-54, and claims 58-59 are dependent on claims 1, 15, 24, 46, 52, and 57, respectively, and are therefore patentably distinguished over Bahl '156, Gravier et al., Stolcke, Bahl et al., and Jelinek, (alone or in

20 any combination) because of their dependency from amended independent claims 1, 15, 24, 46, 52, and 57 for the reasons set forth above, as well as other elements these claims add in combination to their base claim.

All of the pending claims, i.e., claims 1-60, are in condition for allowance and such favorable action is earnestly solicited.

25   If any outstanding issues remain, or if the Examiner has any further suggestions for expediting allowance of this application, the Examiner is invited to contact the undersigned at the telephone number indicated below.

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The Examiner's attention to this matter is appreciated.

Respectfully submitted,

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